

Flexural behavior of reinforced sulphur concrete beams

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Abstract

A study was undertaken to examine the flexural behavior of reinforced sulphur concrete beams. The experimental program consisted of casting and testing a number of simply supported beams divided into two series. The F-series beams, designed for test in flexure, had varied amount of tension steel and were provided with adequate shear reinforcement to prevent premature shear failure prior to the attainment of ultimate load in bending. The S-series beams, used to determine ultimate shear strength were reinforced with two 16-mm tension bars and had varied amount of shear reinforcement in the form of two-legged stirrups. These beams were designed to fail in shear. All beams were tested as simple beams of 46.0 in span. They were fitted with electrical strain gages at the compression zone of the beam at midspan location to record compressive strains due to bending. The load was applied by an Instron Testing Machine and the measured data included the compressive strains, the mid-span deflection, the load at the first crack and the ultimate load at failure.

Using the measured strain data and a polynomial form of stress-strain relationship, the moment resistance of the beams were predicted by a regression model. The results indicate that the stress-strain relationship can be satisfactorily prescribed by a three-degree polynomial and the modelling yields satisfactory results.

Tests show that the behavior of reinforced sulphur concrete beam is essentially similar to that of Portland cement concrete beams, the former showing pronounced ductility in presence of shear reinforcement. The shear strength of the beams depends upon the shear span, the web steel and the longitudinal tension steel. The failure of beams in shear is essentially brittle type, and in absence of web steel, the failure is often explosive.

The load-deflection of the beam is essentially linear for a large portion of the ultimate load and the instantaneous deflection can be predicted with sufficient accuracy by using ordinary bending theory and the gross moment of inertia of the beam section. The measured plots of the compressive strains show that the variation of strain across the depth of the beam is approximately linear.

Based on the finding of the test results, simplified formulas are suggested to compute the bending strength of under-reinforced beams by introducing idealized uniform and trapezoidal type of stress distribution in the compressive zone.